Amendments to the Specification

Please amend the Detailed Description of the Invention as follows:

This invention relates to equal response axles for vehicles 10 having a front engine 15 and a rear wheel drive (non-independent suspension) and is particularly suited for use on racing cars. The invention involves a method and design for equalizing the torque at the tire contact patch. [[The]] As shown in FIG. 3, the engine 15 is connected through a transmission 16 to a drive shaft 17 which ~~drive~~ drives the ~~axels~~ rear axles 13 and 14. In racecars, the right rear axle 13 is normally slightly longer than the left rear axle 14 and this creates problems particularly on turns.

Accordingly, the right and left axles 13 and 14 respectively are machined to different dimensions based on a formula for calculating spring rates (~~tortional~~ torsional stiffness) of torsion bars. "Spring rate" is defined as the amount of force required to move a torsion arm one inch. The intention is to have the same spring rates on each axle 13 and 14. Basically, the calculation uses the static loaded radius (dimension from center of axle to ground) using either static or dynamic weight on the tire (portion of tire flat on the ground).

FIG 1 depicts a weight W being applied to the torsion arm at a distance ℓ which results in a 1° twist in the torsion bar having an effective length L.

FIG. 2 illustrates a 10½″ torsion arm which deflects $2^7/_{16}$" under the load W which can be assumed as 500 pounds. The angle of twist is 11½° where ℓ equals 10½″. The resultant spring rate is 205 inch pounds. While various assumptions have been made to determine the spring rate, variations in the spring rate occur without affecting the theory of this invention.

In Step 1, the polar moment of inertia (J) for a tubular bar is calculated as follows:

STEP 1

Solid Bar

$$J=\frac{(\prod D^4)}{32}$$

Tubular Bar

$$J=\frac{\prod(D1^4-D2^4)}{32}$$

where J=Polar moment of inertia
D=Diameter of bar

D_1=outer diameter
D_2=inner diameter

STEP 2

In Step 2, reference should be made to FIG. 1 for the various parameters.

$$F=\frac{WxL}{[L]\boldsymbol{\ell}}$$

where F=T

F=force

T=torque

L=working length

ℓ=lever length of torsion arm

W=weight or load

STEP 3

$$\theta = \frac{TxL}{GxJ}$$

where [[w]]W=a select weight

F=force in pounds

T=torque in pounds

J=polar moment

G=~~modules~~ modulus of elasticity in shear (PSI)

L=working length-effective length (part of the bar that twists)

ℓ =lever length of torsion arm when used for axels. Static loaded radius is the lever length

θ=angle of twist in radians

Note:

(1) For W use 500 pounds for 1 inch or larger bars-the more weight used the larger the movement of the given bar and the easier to measure

(2) Use 10,750,000 for G with 4140 steel

(3) Answer will be in radians

STEP 4

Multiply the answer in Step 3 by 57.3=Degrees of twist; used to convert angle of twist in radians to degrees of twist.

Refer to FIG. 2 for an understanding of Step 5

STEP 5

(a) Draw a line using torsion arm length

(b) Draw a second line of the same length representing degrees of twist

(c) ~~Drive~~ Divide the load by the distance (deflection).

STEP 6

Divide the load by the distance to obtain the spring rate-spring rate equals the amount of force to move the end of the arm (given length) on a bar (given length) a certain distance

Load=W=500 $\quad\quad \frac{L}{D} = \frac{500}{2\,{}^{7}/_{16}}$ =<u>$205\ inch\ pounds$</u>

Distance $2\,{}^{7}/_{16}$

Using the above formula to dimension the rear axles on high performance or racing cars overcomes the problems associated with an unequal response as torque is delivered unequally to the rear wheels 11 and 12. The problems are caused by the instantaneous weight transfer to the left rear wheel 11 and the fact that the right side axle 13 is longer than the left side 14, yet both conventionally have the same diameter in the effective length of the axle. The fact that the left side axle is shorter with the same diameter <u>as the right side axel</u> means that the left [[rear]] <u>side</u> ~~wheel~~ <u>axel has a higher spring rate. This means that the left rear wheel</u> 11 will lose traction first under hard acceleration<u>.</u> ~~because the shorter axle 14 has a high spring rate (tortionally stiffer), and the~~ <u>The</u> longer axle 13 will twist slightly before spinning the wheel 12. If the right and left axles 13 and 14 are machined to different dimensions determined by the foregoing formulas the problems are overcome. This invention uses the static loaded radius (dimension from center of axle to ground<u> as the lever or arm length of the axel which is a torsion bar</u>) using either straight static or curved dynamic weight on the tire. <u>For tuning purpose even a smaller diameter axel can also be used to help the car turn the more or less under acceleration. The axles are used as tuning devices for the handling of the car.</u>

If you are going through a left hand corner and the car has a slight under steer, a softer <u>(smaller diameter)</u> left rear axle 14 can fix this problem. ~~Also, if you going through a right hand corner under power you must be much more careful not to spin out than if it was a left hand corner.~~ <u>Also, with the smaller diameter left rear axel 14 you are better able to negotiate right hand corners under power without spinning out. </u>There is a torque reaction that takes weight off the right rear wheel 12 and applies it to the left rear wheel 11 <u>on all solid rear axel suspensions. This will result in more grip on the racetrack</u>.

The weight transfer going through a right hand corner is also transferring weight to the left side wheels 11 together. This is loading up the left rear wheel 11 to the point where spinning out becomes all too easy. However, with the proposed ~~"kera"~~ <u>“Kera”</u> axles, if you choose to replace the left rear axle 14 with a smaller diameter, (softer spring rate in twist), the instantaneous weight transfer can be softened (absorbed) in the twisting action of the axle 14 which will result in more grip on the race track.

Applications particularly suited for the invention occur in oval track racing cars, open wheel cars, road racing cars, off road racing vehicles, high performance street cars, sport utility vehicles, pick-up trucks and commercial trucks and buses on all live axle rear wheel drive passenger cars.

In drag racing, the ~~"kera"~~ <u>“Kera”</u> sized axle will allow more even distribution of power under acceleration. Axle sizing is an excellent way of tuning the chassis under acceleration. The "kera" sized axle also helps prevent breakage of drive train parts.

The general advantages for all road vehicles include:

1) Less wheel spin under acceleration;

2) More even application of torque to drive wheels (even wear);

3) Less breakage in drive train;

4) Better response under starting acceleration;

5) Better grip when applying power through corner;

6) More even deceleration;

7) Better drive wheel tire wear.

<u>Since applicant's invention is that to have two axles with the same spring rates and two different lengths, the axles must have different diameters. The right and left rear axles have fixed lengths. By calculating the spring rate for the right rear axle, which has a known diameter, the diameter of the left rear axle may be calculated using the same spring rate.</u>

While the invention has been explained by a detailed description of certain specific embodiments, it is understood that various modifications and substitutions can be made in any of them within the scope of the appended claims, which are intended also to include equivalents of such embodiments.